

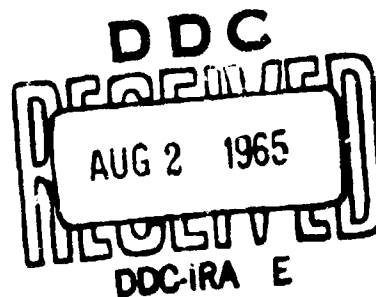
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DIVISION OF BIOLOGY AND AGRICULTURE

REPORT OF THE

PLANNING COMMITTEE ON EUTROPHICATION

May 8-9, 1965



National Academy of Sciences
National Research Council

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The function of the Planning Committee will be to review, analyze, and evaluate the present state of knowledge of the processes of eutrophication and to make such recommendations as the Committee believes necessary to alleviate the problems resulting from eutrophication.

INTRODUCTION

In the words of Aldo Leopold, "the outstanding scientific discovery of the 20th century is not television or radio, but rather the complexity of the land organism."

If water resources are to have optimum value for future generations, in our country and throughout the rest of the world, public and governmental officials, as well as the scientific community, must greatly enlarge their understanding of the biological, chemical, physical, and economic factors relating to and influencing the changes occurring in these resources as a result of man's activities.

Eutrophication of lakes, streams, and estuaries -- the problems resulting from introduction of nutrients to receiving bodies of water, which thus produce an enriched environment -- has been the subject of discussion by this committee.

DISCUSSION

It is not easy to capture the attention of people for a subject that they are not already interested in or informed about, and to break through their resistance to persuasion. Nonetheless, the problems and dangers arising from eutrophication of lakes and other bodies of waters are very real, and the difficulties are accelerating rapidly. Population and industrial growth, together with intensified agriculture, river-basin development, recreational use of public waters, and domestic and industrial exploitation of shore properties are endangering the nation's waters through enrichment. This enrichment of waters causes changes and/or increases in algae, aquatic vascular plant growth, fish populations, and bottom fauna. Such changes usually interfere with the multiple uses of waters, reduce their esthetic qualities and economic value, and by accelerating the "aging" of the waters, threaten the destruction of this resource.

The general public and the whole scientific community should be alerted to the deterioration of the quality of the human environment through the eutrophication of our water resources.

Eutrophication of fresh waters is forcing itself on our attention as a problem of increasing importance in water-resource management. Indeed, the discovery and development of ways and means to prevent and control these man-induced processes are presently the most urgent requirements in the management of standing waters. Emerging from these problems is an urgent need for interdisciplinary action among social, biological, and physical scientists.

Eutrophication is imperfectly understood and difficult to measure, although certain characteristics of lakes related to the phenomenon of eutrophication, e.g., light penetration, shape, and productivity, can be clearly defined. Although comparative limnology has been making great strides, there is urgent need for additional well-designed investigations leading to better understanding of the underlying causes of development of undesirable conditions in water. Paralleling this is the need for more scientists in the field and for greater recognition of the eutrophication problem by scientists in related fields.

Although a number of control practices are being applied to alleviate the problem of eutrophication, they are not adequate and, in some instances, the result is merely to shift the problem from the lake to the streams below the lake. Among the techniques in use are development of interceptor lines and sewers, creation of lagoons, and removal of aquatic plants.

The problem of eutrophication has been in existence for many years and in other parts of the world it is now receiving not only public attention but also governmental action. In some countries positive steps are being taken either to prevent or to reverse the processes contributing to eutrophication.

Any alleviation of eutrophication of our waters will require spending large sums of money, which will become available only after the general public and legislators have become aware of the problem. Hence, there is a great need for dissemination of information concerning

the problem, its causes, and the necessity of a major attack on it. To date, most publicity has been concerned with public health problems and with pollution in streams, and the public is already becoming relatively well informed on these problems. The flow of information in these areas should be continued, but with new emphasis on the growing problems in natural and man-made lakes. The public can be expected to understand the differences in responses of lakes and streams to the addition of essential plant nutrients and other contaminants.

It is imperative that such a public information campaign be carried out by professional science writers and other persons well versed in modern advertising techniques. Recognizing that this will necessarily be a difficult educational process, suitable media should be employed for pre-adult as well as adult levels. The public press by itself is not sufficient; in addition there must be educational films, video tapes, and booklets, for example, that can be used in elementary and secondary schools and by action groups such as the League of Women Voters and other civic-minded organizations. Such an educational campaign, although expensive, would represent only an insignificant fraction of the total cost of pollution control.

In the preparation of educational materials, the scientists who have been active in the over-all problem of pollution and its abatement will be expected to provide the background information needed by the professionals in journalism and public information. This will include, for example, serving as advisers in the development of visual media.

Government, at all levels, is involved in (1) identifying existing conditions, (2) recommending corrective procedures, (3) controlling developing aquatic nuisances, (4) establishing water-quality standards, and (5) enforcing pollution abatement. At the federal level the problem is of concern to the Public Health Service (HEW), the Department of the Interior, the Corps of Engineers, and the Department of Agriculture, as well as authorities such as

the Tennessee Valley Authority and the Federal Housing Administration. At the state level, corresponding agencies are involved. All local governments are similarly involved, individually or in company with others sharing responsibilities for sources of water held in common. Similar areas of overlapping jurisdiction exist among states and with the governments of Canada and Mexico.

It is believed that responsible agencies of government are as yet insufficiently aware of the importance of eutrophication in the management of the nation's water resources. The Committee is of the opinion that the National Academy of Sciences-National Research Council can provide the leadership necessary to channel pertinent information to all levels of government, the scientific and engineering community, and to the general public.

It is necessary to take inventory of the stock of scientific knowledge and activities in this field and to clarify the processes of eutrophication and their implications. Such an inventory is necessary in order to ensure the practicability and soundness of recommendations for corrective action and to anticipate developing problems.

An effective early step would be an international symposium of scientists presently engaged in work related to eutrophication. The major aims of such a symposium would be to take stock of present knowledge and understanding of the problem, to prepare recommendations for effective management of the problem, based on present understanding, and to develop guidelines for future research.

Our growing and vigorous economy, together with the rising population and rapid expansion of industry, will inevitably contribute to enlargement not only of the difficulties attendant upon eutrophication, but also of the cost of alleviating the problem. The Committee is convinced that very little progress will be made in halting and reversing the processes of eutrophication until the general public, the scientific community, and federal, state, and local government officials are in a common effort to that end.

RECOMMENDATIONS

The Planning Committee recommends:

1. That effective measures be taken to inform the general public concerning eutrophication, and the urgency for prevention and cure. That a committee be appointed to prepare an informational booklet summarizing present knowledge of eutrophication and its causes, illustrated by specific examples such as the Great Lakes, Lake Zurich (Switzerland), Madison lakes (Wisconsin), and Lake Washington (Washington). The document should feature the complex problems relating to antiquated laws, government at all levels, community attitudes toward natural resources, research needs, ameliorative measures, and suggestions for further attack on the problem.
2. That the scientific community be alerted to the deterioration of the quality of the human environment through the eutrophication of our water resources. That major studies of eutrophication, and of the steps that can be taken to arrest and reverse the process, be supported. Large-scale demonstration projects could be undertaken on western Lake Erie, Lake Washington (Washington), and the Madison lakes (Wisconsin). These lakes have undergone some of the changes characteristic of eutrophication, and steps are being taken to cope with the problem. A considerable body of data on their past history is also on record. Consequently, they provide opportunity for intensive investigation of the effects of eutrophication and the potential future effects of attempts to improve the situation in these waters. That interdisciplinary training and research on this problem be fostered in the universities and in government agencies. Some representative problems are:
 - (a) Responsibilities of government in the use and management of resources, and the public attitude toward long-term eventualities of a deteriorating aquatic environment.
 - (b) Psychological and sociological aspects, including molding of public opinion toward more favorable attitudes.

- (c) Legal measures and modernization of antiquated laws regarding water resources and water use.
- (d) The relation of the tax base (ability to pay) to the economic needs in industrialization and its effect on our waters.
- (e) Research into the competing uses among industry, government, and the public. The differences in philosophical approaches to a resource of common interest must be resolved.
- (f) The need to develop positive attitudes toward action that may be expensive, such as the immediate diversion of sewage from lakes, even though future research may produce improved methods. An analogous situation exists in national defense, in which expensive weapon systems are replaced by improved ones even though the old ones are still functional.
- (g) Establishment of selected stations for monitoring the physical, chemical, biological, and sociological parameters that have an impact on eutrophication of natural waters. Viz. (i) to determine the relative contributions from agriculture, organic content of domestic sewage, detergents, industry, and the atmosphere, (ii) to determine effect of marshes on water quality, and (iii) to determine effect of (and feasibility of) removal of phosphorus and/or nitrogen (or both).
- (h) Search for new ways to control nuisance growths of algae and aquatic plants as present chemical treatments are injurious to normal plant and animal communities. Harvesting the vegetation is a sensible method, because no foreign chemicals are introduced and some excess nutrients are removed, but it provides only temporary relief. Some disadvantages of chemical control would be avoided by an organic herbicide or inhibitor that would decompose without toxic residue.

- (i) Research toward development of improved methods of sewage disposal, including methods eliminating water as a transport vehicle.
 - (j) Development of methods to prevent loss of nutrients from agricultural soils, and for more efficient use of manures and commercial fertilizers.
 - (k) Development of methods to control combined sewage and storm-water drainage.
 - (l) Research on recovery of various chemicals from waste waters.
3. That government officials at all levels be made more aware of the importance of domestic eutrophication.
4. That a national conference on eutrophication be held in the near future, perhaps in conjunction with an international symposium; and that new information on the present status and future hazards of eutrophication developed at this conference be disseminated to government, the scientific and engineering community, and the general public. Individuals should be invited from countries in which the progress of eutrophication has been sufficiently marked to create special concern and encourage remedial action.
5. That an international symposium on eutrophication be held in order that the present world-wide state of knowledge and understanding of this phenomenon can be discussed in open forum, and recommendations developed for the effective management of problems and for the course of future research. The Committee believes that such a meeting would result not only in improvement of water-resource management but also in important advances in the scientific understanding of aquatic ecosystems. Such an international symposium should be held within the next 18 months. The Committee recommends that an organizing and planning committee be established with
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sufficient lead time to prepare for such a symposium adequately and suggests for consideration, among others, such topics as:

- a. A brief geographical inventory with emphasis on the relation of problems and solutions to geographical factors.
- b. How to evaluate nutrient budgets.
How to evaluate results of eutrophication.
- c. Solutions:
Accomplishment through present techniques.
Possible developments of new or improved kinds of solutions.
- d. How can we salvage scientific value from these experiences? It is hoped that such a symposium would result in:
 - a. A publication
 - b. Recommendations
 - c. Continuing effort
 - d. Communication of the results of the symposium (presumably through NAS-NRC) to government officials involved in eutrophication.

It would be well to consider how to make it possible for scientists to visit laboratories for a short period of time, either in connection with the symposium or as a separately organized operation.

EUTROPHICATION PLANNING CONFERENCE

May 8-9, 1965

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Grateful acknowledgement is made to the Atomic Energy Commission, Department of the Interior, Office of Naval Research, and the National Science Foundation, whose support and assistance made this conference possible.